



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

TW

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--|-------------|----------------------|---------------------|------------------|
| 10/773,822 | 02/06/2004 | Lotfi Hedhli | IR 3699 NP | 7965 |
| 31684 | 7590 | 08/21/2007 | EXAMINER | |
| ARKEMA INC. PATENT DEPARTMENT - 26TH FLOOR 2000 MARKET STREET PHILADELPHIA, PA 19103-3222 | | | TUROCY, DAVID P | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1762 | |
| | | | MAIL DATE | DELIVERY MODE |
| | | | 08/21/2007 | PAPER |

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

| | | | |
|------------------------------|--------------------------------------|--------------------------------------|--|
| Office Action Summary | Application No. 10/773,822 | Applicant(s) HEDHLI ET AL. | |
| | Examiner David Turocy | Art Unit 1762 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 July 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-9 and 11-16 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-9 and 11-16 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7/12/2007 has been entered.

Response to Amendment

2. Applicant's amendments, filed 7/12/07, have been fully considered and reviewed by the examiner. The examiner notes the amendment to claim 1. Therefore Claims 1, 3-9, and 11-16 remain pending in the instant application.

Response to Arguments

3. Applicant's arguments filed 7/12/2007 with respect to Fukuda '306 have been fully considered but they are not persuasive.

The applicants have argued against the Fukuda '306 reference stating that the reference fails to disclose a single mixed gas stream of reactants in a carrier gas as now currently required by the amended claim. However, the examiner disagrees. It is the examiners position that the processes of Fukuda '306 will necessarily a degree of mixing at the interface between the two gases, reactant and carrier. Therefore this single gas mixture will necessarily read on the claim as written, where the claim requires

Art Unit: 1762

a single mixed gas stream directly between two electrodes and the additional non mixed gas streams are not excluded from the claim as written. See the claims construction including comprising language which is interpreted to be open to other process steps and parameters that are not present in the claims.

The applicants argue against the Fukuda '306 reference stating the reference teaches away from the instant invention, only discloses nitrogen as a secondary list, and stating that it is used in combination with noble gases not alone. The examiner disagrees with such allegations. The examiner is not contending that Fukuda '306 teaches nitrogen is the preferred embodiment, and the examiner notes the examples use helium and argon; however, Fukuda '306 teaches nitrogen is operable. Therefore, such a teaching is not a teaching away because Fukuda '306 does not disclose nitrogen fails to work. The statement, "Nitrogen can be also use as the inert gas", does not teach that nitrogen has to be used in combination with the other inert gases, but teaches that the inert gas may be only nitrogen. As cited as pertinent art in the previous office action, JP 10-275698 teaches forming atmospheric plasma without using a rare gas to greatly reduce the consumption thereof. Therefore even if the applicants position were correct and Fukuda '306 discloses a process with nitrogen in combination with a rare gas, JP 10-275698, motivates one to modify that method to use no rare gas to greatly reduce the consumption.

The applicant argues against the Hammerschmidt reference stating the reference discloses other various coating techniques and such techniques are different from the claimed technique. While the examiner agrees Hammerschmidt discloses varying

Art Unit: 1762

techniques, it is clear that those techniques are not meant to be limited but only exemplary of possible techniques.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). The applicant has argued against Hammerschmidt in view of Fukuda '306 combined with Schutz, Yasumoto, Namaumi, Kamo, Haug, stating only what the tertiary reference fails to teach. Therefore, the examiner maintains that the obviousness of the rejection is based on the combination of the teachings and what those teachings suggest to one of ordinary skill in the art. The test of obviousness is not an express suggestion of the claimed invention in any or all references, but rather what the references taken collectively would suggest to those of ordinary skill in the art presumed to be familiar with them (*In re Rosselet*, 146 USPQ 183). Accordingly, the examiner is maintaining the rejection below.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claim 1, 3, 5-6, and 11-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6010798 by Hammerschmidt et al ("Hammerschmidt") in view of US Patent 6849306 by Fukuda et al ("Fukuda '306"), US Patent Publication 2003/02032136 by Fukuda et al ("Fukuda '136") and JP 10-275698.

Claims 1, 3, and 11-13: Hammerschmidt discloses a method for depositing a catalyst on a fuel cell electrode for use in a membrane electrode assembly under plasma chemical vapor deposition (abstract). Hammerschmidt discloses using a fuel cell electrode comprising a carbon cloth and membranes including carbon particles (Column 3, lines 15-25). Hammerschmidt discloses known polymer electrolyte membranes utilized in fuel cells including NAFION (Column 1, lines 55). Hammerschmidt discloses the preferred catalyst is platinum or platinum alloy (Column 1, line 26).

Hammerschmidt fails to disclose atmospheric plasma CVD by passing the reactants and including a carrier gas through the electrical discharge (Page 1689, Column 2, last paragraph).

However, Fukuda '306, teaching a known method of plasma coating surfaces at atmospheric pressure, discloses forming a catalyst layer by passing reactants and the carrier gas through an electrical discharge at atmospheric pressure (abstract, figures, Column 5, lines 25-42). Fukuda '306 discloses passing the reactants and carrier gas through a nozzle containing parallel-arranged electrodes and passing the gases directly between two electrodes (figure 1). Fukuda '306 discloses a substrate of a polymer substrate because of the low temperature of the plasma discharge (Column 6, lines 52-55). Fukuda '306 discloses the substrate advances beneath the nozzle (figures). Fukuda '306 discloses atmospheric pressure allows for increased production and films with uniform composition and physical properties (Column 1, lines 31-43).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Hammerschmidt to use the atmospheric pressure plasma jet as suggested by Fukuda '306 to provide a desirable catalyst coating on a fuel cell electrode with the reasonable expectation of success because Fukuda '306 discloses atmospheric pressure is advantageous because one would desire to reap the benefits of increased production and films with uniform composition and physical properties.

Fukuda '306 discloses supplying a reactant organometallic gas alone through the parallel electrode (11) and therefore, giving the claim the broadest reasonable interpretation, a portion of the gas supplied through (11) can be considered a carrier gas

Art Unit: 1762

and such a carrier gas does not include an inert gas. During patent examination, the pending claims must be "given the broadest reasonable interpretation consistent with the specification" by giving words their plain meaning unless the specification provides a clear definition. See *In re Prater* 415 F.2d 1393 1404-05 162 USPQ 541 and *In re Zletz* 893 F.2d 319, 321, 13 USPQ2d 1320.

Alternatively, Hammerschmidt in view Fukuda '306 fails to explicitly state using a carrier gas without adding a noble gas. Fukuda '306 discloses using an inert gas as the carrier gas and discloses nitrogen (Column 5, lines 58-Column 6, line 5). Fukuda '136 discloses that it is known in the art of atmospheric plasma generation to eliminate the use of noble gases during the plasma formation, including using any number of gases as the plasma generation gas (see for example paragraph 0010, 0187). Fukuda '136 discloses using such gases singularly, including nitrogen, because such is cheap and safe for discharging a plasma (see for example 0010, 0187). Additionally, JP 10-275698 teaches forming atmospheric plasma without using a rare gas to greatly reduce the consumption thereof.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to select any inert carrier gas, including nitrogen, because Fukuda '306 teaches of using nitrogen as the inert gas is suitable for atmospheric pressure plasma deposition. The selection of something based on its known suitability for its intended use has been held to support a *prima facie* case of obviousness. *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945).

Also, it would have been obvious to one of ordinary skill in the art to have modified Hammerschmidt in view of Fukuda '306 to use an atmospheric plasma using nitrogen as the discharge gas because Fukuda '136 discloses such results in a safe and cheap plasma discharge and JP 10-275698 discloses that removing noble gases from the discharge gas greatly reduces the consumption of rare gases.

While the examiner maintains the position as discussed in section 3 above, with regard to Fukuda '306 discloses a single mixed gas or reactants and carrier gas. The examiner cites here Fukuda '136 as a teaching of supplying the combination of reactant gas and carrier gas directly between the two electrodes as a single gas mixture (see figures). Therefore Fukuda discloses that such an arrangement is known and suitable in the art of atmospheric plasma generation and it would have been obvious to one of ordinary skill in the art to have modified Hammerschmidt in view of Fukuda '306 to supply a single mixture of reactant gas and carrier gas directly between two electrodes because such is known in the art and one of ordinary skill in the art would have expected to successfully provide an atmospheric plasma.

Claim 5: Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 fails to explicitly disclose scanning the nozzle over the substrate, however, Fukada discloses moving the substrate relative to the nozzle and there are three equivalent ways to coat a large surface, moving nozzle with a stationary substrate, moving substrate with a stationary nozzle, or moving both the nozzle and the substrate all of which is within the skill of one ordinary in the art. Substitution of equivalents requires no

Art Unit: 1762

express motivation. *In re Fount*, 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152, USPQ (CCPA 1967). Alternatively, it would have been obvious to one of ordinary skill in the art to modify Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to scan the nozzle over the substrate with a reasonable expectation of successfully coating the membrane. The prior art can be modified or combined to reject claims as prima facie obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375.

7. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 and further in view of Schütze et al ("Schütze").

Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teach all the limitations of these claims as disclosed in the 35 USC 103(a) rejection above, including providing an electrical discharge by parallel electrodes, but the references fails to teach of coaxial electrodes.

However, Schütze, teaching of an atmospheric plasma jet, discloses known and suitable methods for producing an electrical discharge include parallel electrode plates and coaxially arranged electrodes (Page 1690 Paragraph bridging column 1 and 2, Page 1689 Column 1 Last Paragraph). Therefore Schütze discloses parallel plate electrodes are equivalent to coaxially arranged electrodes for providing an electrical discharge during atmospheric plasma generation. Substitution of equivalents requires

Art Unit: 1762

no express motivation. *In re Fount*, 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152, USPQ (CCPA 1967).

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 and further in view of US Patent Publication 2003/0096154 by Yasumoto et al ("Yasumoto").

Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teach all the limitations of these claims as disclosed in the 35 USC 103(a) rejection above, but they fail to teach spraying the catalyst on the surface of the polymer electrolyte membrane.

However, Yasumoto, teaching of a method for spraying a catalyst with a carrier gas, teaches of spraying the catalyst directly onto the surface of the polymer electrolyte film or onto a porous conductive electrode substrate (Paragraph 0014). Yasumoto also discloses by spraying directly onto the film, the catalysts particles become embedded in the film and therefore the cell performance is improved (Paragraph 0016).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to apply the catalyst directly onto the surface of the polymer electrolyte membrane as suggested by Yasumoto to provide a desirable catalyst layer on a electrolyte membrane with the reasonable expectation of success because Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teaches spraying a catalyst on a porous electrode film and Yasumoto teaches that spraying the catalyst

Art Unit: 1762

directly onto the polymer electrolyte membrane increase the cells performance over a catalyst sprayed on a porous electrode film.

9. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 and further in view of US Patent Publication 2004/0180250 by Nanaumi et al ("Nanaumi").

Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teach all the limitations of these claims as disclosed in the 35 USC 103(a) rejection above, but they fail to teach spraying the catalyst on the surface of the polymer electrolyte membrane comprising a acrylic based polyelectrolyte/fluoropolymer blend or a polyhydrocarbon-based sulfonic acid.

However, Nanaumi, polymer electrolyte membrane structures that provide inexpensive electrode structure and have excellent power generation efficiency, discloses using a hydrocarbon-based sulfonic acid (Paragraph 0007, 0010). Nanaumi teaches that such electrolyte polymer membranes comprise copolymers of an acrylic based polymer and a fluoropolymer (Paragraph 0012-0015).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to use the polymer electrolyte membrane structure suggested by Nanaumi to provide a desirable catalyst on a membrane with the reasonable expectation of success because Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to teaches depositing a catalyst onto a polymer electrolyte membrane and Nanaumi

Art Unit: 1762

teaches of known polymer electrolyte membrane structures that are inexpensive and have excellent power efficiency.

10. Claim 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 and further in view of US Patent Publication 2003/0059659 by Kamo et al ("Kamo").

Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teach all the limitations of these claims as disclosed in the 35 USC 103(a) rejection above, but they fail to teach of a catalyst layer including a binary and ternary platinum alloy using metals from column 4-11 of the periodic table.

However, Kamo, teaching of fuel cell equipment using an electrolyte membrane, discloses while the cathode catalysts is known to be fine platinum particles, the anode side comprise fine particles of platinum and ruthenium or platinum/ruthenium alloys (paragraph 0066). In addition Kamo discloses it is advantageous to combine the noble metal components with a third component selected from iron, tin, rare earth elements, etc. to stabilize and extend the life of the electrode (Paragraph 0067).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to use the platinum/ruthenium alloy as suggested by Kamo to provide a desirable catalyst layer on a electrolyte membrane with the reasonable expectation of success because Hammerschmidt in view Fukuda '306, Fukuda '136 teaches an polymer electrolyte membrane with a platinum catalyst layer and Kamo teaches that

platinum/ruthenium alloy is a known substitute for platinum and ruthenium particles for an anode catalyst and additional elements increase the catalyst stability and life span.

11. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 and further in view of Haug et al ("Haug").

Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teach all the limitations of these claims as disclosed in the 35 USC 103(a) rejection above, but they fail to teach of depositing multiple catalyst layers.

However, Haug, teaching of increasing the PEM catalyst effectiveness, discloses using a multilayer electrode technique increases the regions of active platinum by increasing the number of platinum layers deposited (Pg A284, Column 2 last paragraph). In addition, Haug discloses that Membrane electrode assemblies with multiple layers of platinum outperform those with only a single layer (Page A285, Column 1, First Paragraph).

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 to use the multiple platinum layers as suggested by Haug to provide a desirable catalyst layer on a electrolyte membrane with the reasonable expectation of success because Hammerschmidt in view Fukuda '306, Fukuda '136 and JP 10-275698 teaches an polymer electrolyte membrane with a platinum catalyst layer and Kamo teaches that

Art Unit: 1762

multiple platinum layers increases the region of active platinum over a single platinum layer.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. JP 10-275698 teaches forming atmospheric plasma without using a rare gas to greatly reduce the consumption thereof.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Turocy whose telephone number is (571) 272-2940. The examiner can normally be reached on Monday-Friday 8:30-6:00, No 2nd Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

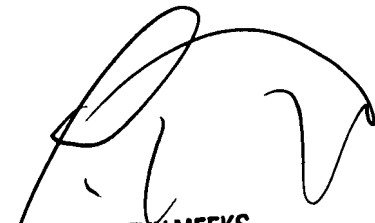
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 10/773,822

Page 15

Art Unit: 1762

David Turocy
AU 1762



TIMOTHY MEEKS
SUPERVISORY PATENT EXAMINER